

to the figures in order to clarify the meaning of the terms in the specification. Additionally, the lines indicating the location of the numerical indicators have been amended to remove the crooked lines and replace them with straight lines. In addition, on page 6, line 10 of the specification, Applicants have added the phrase “of the blocks” to clarify the meaning of the sentence. No new matter has been added.

Rejections Under 35 U.S.C. §112, Second Paragraph

The Examiner has rejected claims 3, 9, 19, 23 and 27 under 35 U.S.C. §112, second paragraph as indefinite. Applicants have amended claim 3 to clarify the claim language. Applicants submit that the amended claim is sufficiently clear in light of the description provided in the specification as understood by one of ordinary skill in the art.

The Examiner also rejected claims 9, 19, 23, and 27 as being indefinite as reciting “may be” in their respective lines 2. Applicants have amended the claims to replace the words “may be” with the word “are.” Applicants respectfully submit that the amendment clarifies any indefiniteness in claims 9, 19, 23, and 27.

In view of the amendments to claims 3, 9, 19, 23, and 27, Applicants respectfully request reconsideration of the rejections made under 35 U.S.C. §112, second paragraph.

Rejections Under 35 U.S.C. §102(b)

The Examiner has rejected claims 1, 4-7, 10, 15, 16, 25, and 28 under 35 U.S. C. 102(b) as being anticipated by Haener. Applicants have amended claims 1-4 to clarify the limitations of the invention. This amendment takes limitations previously considered by the Examiner as “a statement of intended use of the invention,” out of the preamble and places them into the claim as a limitation or feature of the invention.

The amended claims cover an interlocking modular block system for mortarless wall assembly that includes three different block configurations. This limitation is not taught in the Haener patent, which teaches a two block system, and indeed expressly teaches away from a system that includes three or more block configurations as being undesirable. The background section of the Haener patent, at Col. 1, lines 45-51, refers to three or more block configurations

but does not describe the particular three-block system that is claimed in the instant application. For example, Haener does not describe a three-block system in which the first and second blocks (stretcher and corner blocks) have lengths at least one and a half times the width, and the third block (half block) has the same width and a length up to half the length of the stretcher and corner blocks, which are limitations that are taught in the instant application. Because Haener does not teach the block system Applicants claim, Haener does not anticipate the instant invention.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejections of claims 1, 4-7, 10, 15, 16, 25, and 28 under U.S. C. §102(b) as anticipated by Haener.

Rejections Under 35 U.S.C. §103(a)

The Examiner has rejected claims 8, 9, 26, and 27 under 35 U.S.C. 103(a) as being unpatentable over Haener. According to the Examiner, the Haener reference teaches all the elements of the claimed invention. As described above, claims 1-4 have been amended to move the limitations from the preamble into the body of the claim, thereby clarifying that they are limitations or features of the invention. As described above, Applicants believe that the claims as amended include limitations not disclosed by Haener.

To establish a *prima facie* showing of obviousness requires motivation to modify the reference make the proposed invention, a reasonable expectation of success, and the prior art reference(s) must teach or suggest all the limitations of the claimed invention. The Haener reference does not meet these requirements because the reference does not teach or suggest all the claimed limitations of the claimed invention. Haener teaches a two block configuration for interlocking mortarless building block system, but does not teach or suggest the use of a three block system, and in fact teaches away from systems that utilize three or more block configurations. The background section of the Haener patent, at Col. 1, lines 45-51, describes systems utilizing three or more different block configurations as problematic, and states: “Additional block configurations require the manufacture of additional expensive molds and increased cost and time in changing molds in a block making machine and maintaining and

inventory of the different block configurations.” This description in the background clearly is intended to distinguish a system that utilizes three or more different block configurations from the Haener invention and its two block configuration.

As described above, to establish a *prima facie* showing of obviousness requires evidence of motivation to modify the teaching in Haener to get a three-block system and there must also be a reasonable expectation of success based on Haener. The fact that Haener teaches away from a block system utilizing more than two block configurations and in fact expressly indicates the drawbacks of such systems, demonstrates that the Haener reference provides no motivation to modify its teaching to result in a three block system, and in addition, given the teaching of the Haener reference, one of ordinary skill in the art would have no reasonable expectation of success with a block system of three or more block configurations.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection of 8, 9, 26, and 27 under 35 U.S.C. 103(a) as being unpatentable in view of Haener.

The Examiner has rejected claims 2, 11, 12, 17, 18, 19, and 20, as being unpatentable over Haener in view of Brewington. As described above, claims 1-4 have been amended to move the limitations from the preamble into the body of the claim, thereby clarifying that they are limitations or features of the invention. As described above, Applicants believe that the claims as amended include limitations not disclosed by Haener and not disclosed by Brewington.

To establish a *prima facie* showing of obviousness requires motivation to combine the two references, a reasonable expectation of success, and the prior art reference or combination of references must teach or suggest all limitations of the claimed invention. The combination of the Haener and Brewington references does not meet these requirements because taken together the references do not teach or suggest all the limitations of the claimed invention. Haener teaches a two-block configuration for an interlocking mortarless building block system, but does not teach or suggest the use of a three block system, and in fact teaches away from a system utilizing blocks with three or more configurations. Brewington teaches a single building block configuration. Neither references teaches or suggests the use of a three-block system.

Applicants respectfully submit that combining the teaching of Haener with a single limitation (the crossbar) from the single-block system of Brewington, which teaches only a single-block system, would not result in the three-block configuration of the claimed invention. Therefore the requirement for a *prima facie* case of obviousness has not been met.

The additional requirements to establish a *prima facie* showing of obviousness, that there be motivation to combine the two references and there be a reasonable expectation of success, have also not been satisfied. The Examiner states that one of ordinary skill in the art would modify the block of Haener to include protruding end walls, which are taught in Brewington. Applicants submit that there is no motivation to combine the teaching of the two-block system of Haener with a single-block system of Brewington in any way that results in a three-block system. As described above, Haener expressly teaches the drawbacks of a system of three or more block configurations, and Brewington teaches a single block system. The lack of any suggestion, and indeed the presence in Haener of a negative assessment of block systems with more than two block configurations, clearly demonstrates that one of ordinary skill in the art would have no motivation to combine these references and would also have no expectation of success of a three-block system based on a combination of Haener with Brewington.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 2, 11, 12, 17, 18, 19, and 20, as being unpatentable over Haener in view of Brewington.

The Examiner has rejected claims 3, 13, 14, and 21-24, as being unpatentable over Haener in view of Mullins. As described above, claims 1-4 have been amended to move the limitations from the preamble into the body of the claim, thereby clarifying that they are limitations or features of the invention. As described above, Applicants believe that the claims as amended include limitations not disclosed by Haener and not disclosed by Mullins.

To establish a *prima facie* showing of obviousness requires motivation, a reasonable expectation of success, and the prior art reference or combination of references must teach or suggest all the claimed limitations. The combination of the Haener and Mullins references does

not meet these requirements because taken together the references do not teach or suggest all the limitations of the claimed invention.

Haener teaches a two block configuration for an interlocking mortarless building block system, but does not teach or suggest the use of a three block configuration, and as noted above teaches away from systems with three or more block configurations. Mullins teaches a four building block configuration. Neither reference teaches or suggests the use of a three block configuration system, and therefore, the combination of these references would not result in the claimed invention. In addition, one of ordinary skill in the art would have no motivation to combine the teaching of the Haener and Mullins references because Haener teaches away from systems of blocks that have three or more different block configurations, which is in direct conflict with Mullins' four block configuration system. The conflicting teaching in the Haener and Mullins references also indicates that one of ordinary skill in the art would have no reasonable expectation of success in combining the teachings of two-block and four-block building systems to obtain the instant claimed invention.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 3, 13, 14, and 21-24, as being unpatentable over Haener in view of Mullins.

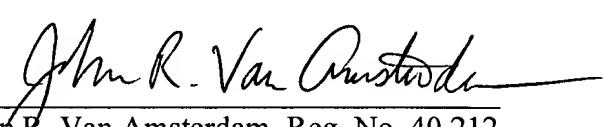
CONCLUSION

In view of the foregoing amendments and remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes, after reviewing the amendments and this response, that the application is not in condition for allowance, the Examiner is requested to call the Applicants' attorney at the telephone number listed below.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicants hereby request any necessary extension of time. If there is a fee occasioned by this response, including an extension fee that is not covered by an enclosed check, please charge any deficiency to Deposit Account No: 23/2825.

Respectfully submitted,

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X8/29/02x

Marked-Up Claims

1.(amended) An interlocking modular block system for mortarless wall assembly, comprising:
[in which]

 a plurality of blocks [are] laid up in courses in a staggered relationship,
 wherein three different block configurations are provided, stretcher and corner blocks
 having lengths at least one and a half times the width, and half block having the same width and
 a length up to half the length of stretcher and corner blocks, said blocks comprising:

 a pair of spaced, parallel, upright sidewalls having flat top and bottom surfaces, said
 sidewalls having block-interlocking means;

 a first transverse end wall extending between said sidewalls spaced from a second end of
 said blocks; and

 a second transverse end wall extending between said sidewalls spaced from a second end
 of said blocks.

2.(amended) An interlocking modular block system for mortarless wall assembly, comprising
[in which]

 a plurality of blocks [are] laid up in courses in a staggered relationship according to
 claim 1 wherein the stretcher block comprises:

 a pair of spaced, parallel, upright sidewalls (1, 2) having flat top and bottom surfaces,
 said sidewalls having block-interlocking means (3, 4, 5, 6) on opposed ends thereof;

 a first transverse, protruding end wall (7) extending between said sidewalls at a first end
 of said block; and

 a second transverse, protruding end wall (8) extending between said sidewalls spaced
 from a second end of said block.

3.(amended) An interlocking modular block system for mortarless wall assembly, comprising
[in which]

 a plurality of blocks [are] laid up in courses in a staggered relationship according to
 claim 1 wherein the corner block comprises:

a pair of spaced, parallel, upright sidewalls (9, 10) having flat top and bottom surfaces, said sidewalls having block-interlocking means (11, 12, 13, 14) on opposed ends thereof;

a first transverse end wall (15) extending between said sidewalls at a first end of said block;

a second transverse end wall (16) extending between said sidewalls spaced from a second end of said block;

a transverse upright support web (17) spans said sidewalls, is integral and defines [defining]a cavity for receiving cementitious material therein; and

protrusions (18) on the inside of sidewalls, extending from a base substantially coplanar with said sidewall bottom surfaces and having tips extending above said sidewall top surfaces configured to interlock with a block in a next succeeding course.

4.(amended) An interlocking modular block system for mortarless wall assembly, comprising [in which]

a plurality of blocks [are] laid up in courses in a staggered relationship according to claim 1 wherein the half block comprises:

a pair of spaced, parallel, upright sidewalls (19, 20) having flat top and bottom surfaces, said sidewalls having block-interlocking means (21, 22);

a first transverse end wall (23) extending between said sidewalls at a first end of said block;

a second transverse end wall (24) extending between said sidewalls spaced from a second end of said block; and

a protrusion (25) on the inside of said sidewalls, extending from a base substantially coplanar with said sidewall bottom surfaces and having a tip extending above said sidewall top surfaces configured to interlock with a block in a next succeeding course.

9.(twice amended) The interlocking modular block system for mortarless wall assembly according to claim 1, wherein the blocks can [may] be used to house lintels without requiring the use of form work.

19.(amended) The interlocking modular block system for mortarless wall assembly according to claim 2, wherein the blocks can [may] be used to house lintels without requiring the use of form work.

23.(amended) The interlocking modular block system for mortarless wall assembly according to claim 3, wherein the blocks can [may] be used to house lintels without requiring the use of form work.

27.(amended) The interlocking modular block system for mortarless wall assembly according to claim 4, wherein the blocks can [may] be used to house lintels without requiring the use of form work.

Clean Copy and Marked-Up Specification

Attached hereto.



INTERLOCKING MORTARLESS LOAD BEARING BUILDING BLOCK SYSTEM

Related Applications

This application claims priority under 35 U.S.C. §119 from Malaysian patent
5 application serial number PI 20001555, filed April 12, 2000.

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GROUP 3600

Technical Field of the Invention

The present invention generally relates to construction materials and, more particularly to a mortarless load bearing building block system of an improved type.

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Background of the Invention

Conventional concrete block walls are laid up by a time-consuming difficult procedure which involves troweling a layer of concrete mortar onto a level concrete or stone base or the like, or the top of a course of previously laid blocks and then setting blocks one at 15 a time in the mortar layer, in each instance also applying mortar to the end walls of each block to join the blocks together. This procedure is continued until the required number of courses are laid. Great care must be taken to keep each course perfectly horizontal and straight. Few people have the skill to carry out such a procedure in a competent manner, therefore the cost of such construction is always high.

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Various types of interlocking blocks have been devised in the past to facilitate the construction of block walls and other structures. Most such blocks have been very expensive to produce since the interlocking portions, usually grooves or protrusions, are normally cut into the blocks after they have been formed by molding. Moreover, it is difficult to maintain the required tight tolerances for accurate construction of large walls or other structures 25 through the molding and cutting steps. The prior blocks often required additional finishing or grinding steps to meet the required tolerances.

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Interlocking mortarless building blocks overcoming many of these deficiencies are described in U.S. Patent Nos. 3,888,060 and 4,640,071. Those blocks have been used successfully for many years. These blocks are assembled in courses, with the block joints staggered and continuous vertical open cells into which reinforcing bars and wet concrete can be inserted. While highly effective, these blocks require that the reinforcing bar be inserted in lower courses, with blocks in later courses lifted over the ends of the reinforcing bar as the

structure advances and wet concrete is periodically poured into the cells containing the reinforcing bar.

Thus installing blocks over the reinforcing bar can be a significant problem with tall structures.

5 Therefore, there is a continuing need for improvements in mortarless building block systems to permit lower cost block manufacture, and lower cost and more rapid structure assembly from the blocks. It would also be desirable to be able to provide an improved mortarless building block system featuring improved adaptability, strength and economy. The design of the block should be such that it can be readily molded and released from the 10 forming mold with full detail preserved, obviating any subsequent reshaping, finishing, etc. Further, the block should be easily strengthened with reinforcing materials, if needed, and be capable of being fabricated in a full array of sizes and shapes.

Summary of the Invention

15 Accordingly, it is the object of the present invention to provide an interlocking modular block system for mortarless wall assembly.

This and other objectives of the present invention are accomplished in one aspect of the invention by providing an interlocking modular block system for mortarless wall assembly in which a plurality of blocks are laid up in courses in a staggered relationship 20 wherein three different block configurations are provided, the first and second blocks (stretcher and corner blocks) having lengths at least one and a half times the width, and the third block (half block) having the same width and a length up to half the length of the stretcher and corner blocks, said blocks comprising a pair of spaced, parallel, upright sidewalls having flat top and bottom surfaces, said sidewalls having block-interlocking 25 means; a first transverse end wall extending between said sidewalls at a first end of said blocks; and a second transverse end wall extending between said sidewalls spaced from a second end of said blocks.

According to another aspect, the invention provides an interlocking modular block system for mortarless wall assembly in which a plurality of blocks are laid up in courses in a 30 staggered relationship wherein the stretcher block comprises: a pair of spaced, parallel, upright sidewalls (1, 2) having flat top and bottom surfaces, said sidewalls having block-interlocking means (3, 4, 5, 6) on opposed ends thereof; a first transverse, protruding end wall (7) extending between said sidewalls at a first end of said block; and a second transverse,

protruding end wall (8) extending between said sidewalls spaced from a second end of said block.

According to still another aspect, the invention provides an interlocking modular block system for mortarless wall assembly in which a plurality of blocks are laid up in courses in a staggered relationship wherein the corner block comprises: a pair of spaced, parallel, upright sidewalls (9, 10) having flat top and bottom surfaces, said sidewalls having block-interlocking means (11, 12, 13, 14) on opposed ends thereof; a first transverse end wall (15) extending between said sidewalls at a first end of said block; a second transverse end wall (16) extending between said sidewalls spaced from a second end of said block; a transverse upright support web (17) spans said sidewalls, integral and defining a cavity for receiving cementitious material therein; and protrusions (18) on the inside of sidewalls, extending from a base substantially coplanar with said sidewall bottom surfaces and having tips extending above said sidewall top surfaces configured to interlock with a block in a next succeeding course.

According to a further aspect, the invention provides an interlocking modular block system for mortarless wall assembly in which a plurality of blocks are laid up in courses in a staggered relationship wherein the half block comprises: a pair of spaced, parallel, upright sidewalls (19, 20) having flat top and bottom surfaces, said sidewalls having block-interlocking means (21, 22); a first transverse end wall (23) extending between said sidewalls at a first end of said block; a second transverse end wall (24) extending between said sidewalls spaced from a second end of said block; and a protrusion (25) on the inside of said sidewalls, extending from a base substantially coplanar with said sidewall bottom surfaces and having a tip extending above said sidewall top surfaces configured to interlock with a block in a next succeeding course.

The interlocking modular block system according to the present invention enables construction of load-bearing and non-load bearing walls without using cement mortar layers between the building blocks. The system is also designed to withstand different types of stresses which may develop from the applied loads. In addition, the configurations of the unit blocks are simple, they are easily constructed, satisfy structural performance for residential buildings, up to five storeys, and the self-alignment features of the blocks enable fast construction even when using unskilled labor.

Brief Description of the Drawings

Other aspects of the present invention and their advantages will be discerned after studying the detailed description in conjunction with the accompanying drawings in which:

5 [Fig. 1 Stretcher Block Unit.

- a. perspective view of the stretcher block unit.
- b. side view of the stretcher block unit.
- c. top view of the stretcher block unit.

Fig. 2 Corner Block Unit.

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- a. perspective view of the corner block unit.
- b. side view of the corner block unit.
- c. top view of the corner block unit.

Fig. 3 Half Block Unit.

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- a. perspective view of the half block unit.
- b. side view of the half block unit.
- c. top view of the half block unit.

Fig. 4 Procedure for constructing a wall with horizontal stiffener.

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- a. First stage – placing the plastic sheet.
- b. Second stage – laying the next course.
- c. Third stage – placing the steel and casting the stiffener.
- d. The completed wall comprising a steel bar and stiffener.

Fig. 5 Procedure for casting vertical ties.

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- a. First stage – laying and casting the first course.
- b. Second stage – constructing 1 meter masonry and casting the vertical stiffener.
- c. Third stage – casting the 2nd meter of the stiffener.

Fig. 6 Construction of corner connection showing the arrangement of blocks in the first, second and third courses.

Fig. 7 Procedure for constructing a wall with door opening.

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- a. First stage – laying the first course and identifying the door opening.
- b. Second stage – constructing 1 meter masonry and casting vertical stiffeners.
- c. Third stage – casting the lintel.

d. Fourth stage – the completed wall with door opening.

Fig. 8 Procedure for constructing wall with window opening.

- a. First stage – constructing 1 meter masonry and casting the vertical stiffeners, with horizontal stiffener below window.
- 5 b. Second stage – constructing the 2nd meter of the wall and casting the lintel.
- c. Third stage – the completed wall with window opening.]

Fig. 1 shows a Stretcher Block Unit. Figure 1a is a perspective view of the stretcher block unit. Figure 1b is a side view of the stretcher block unit. Figure 1c is a top view of the stretcher block unit. (1,2 indicate sidewalls; 3, 4, 5, 6 indicate interlocking means; 7, 8 indicate transverse protruding end walls).

Fig. 2 shows a Corner Block Unit. Figure 2a is a perspective view of the corner block unit. Figure 2b is a side view of the corner block unit. Figure 2c is a top view of the corner block unit. (9, 10 indicate sidewalls, 11, 12, 13, 14 indicate interlocking means, 15, 16 transverse end walls, 17 a transverse web, 18 protrusions).

Fig. 3 shows a Half Block Unit. Figure 3a is a perspective view of the half block unit. Figure 3b is a side view of the half block unit. Figure 3c is a top view of the half block unit. (9,10 sidewalls, 21, 22 interlocking means, 23, 24 transverse end walls, 25 protrusion).

Fig. 4 shows a procedure for constructing a wall with horizontal stiffener. Figure 4a shows placing the plastic sheet (26). Figure 4b shows laying the next course on the plastic sheet (26). Figure 4c shows placing the steel (27) and casting the stiffener (28). Figure 4d shows the completed wall comprising a steel bar (27) and stiffener (28).

Fig. 5 shows a procedure for casting vertical ties. Figure 5a shows laying and casting the first course. Figure 5b shows constructing 1 meter masonry and casting the vertical stiffener (28). Figure 5c shows casting the 2nd meter of the stiffener (28). Steel is indicated as (27) and stiffener is indicated as (28).

Fig. 6 shows an exploded view of the construction of a corner connection showing the arrangement of blocks in the (Figure 6a) first, (Figure 6b) second and (Figure 6c) third courses.

5 Fig. 7 shows a procedure for constructing a wall with door opening. Figure 7a shows laying the first course and identifying the door opening. Figure 7b shows constructing 1 meter masonry and casting vertical stiffeners (28). Figure 7c shows casting the lintel. Figure 7d shows the completed wall with door opening. Steel is indicated as (27) and stiffener is indicated as (28).

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Fig. 8 shows a procedure for constructing a wall with window opening. Figure 8a shows constructing 1 meter masonry and casting the vertical stiffeners, with horizontal stiffener below a window. Figure 8b shows constructing the 2nd meter of the wall and casting the lintel. Figure 8c shows the completed wall with window opening. Steel is indicated as (27) and stiffener is indicated as (28).

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Detailed Description of the Invention

Figs. 1, 2 and 3 show the perspective, side and top views of the stretcher, corner end half block units respectively, in accordance to the present invention.

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Fig. 1a shows the perspective view of the stretcher block unit. As can be seen from Fig. 1a, there are a pair of sidewalls (1, 2), interlocking means (3, 4, 5, 6) on opposed ends of sidewalls, male interlocking means located at one end of the sidewalls and female interlocking means located on the opposite ends of the sidewalls, and a pair of transverse, protruding end walls (7, 8). Fig. 1b shows the side view of the stretcher block unit as seen from the side of transverse wall (7), while Fig. 1c shows the top view of the stretcher block unit.

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Fig. 2a shows the perspective view of the corner block unit. It shows a pair of sidewalls (9, 10), comprising interlocking means (11, 12, 13, 14), male interlocking means at one end of sidewalls and female interlocking means on the opposite ends of the sidewalls, a pair of transverse end walls (15, 16), a transverse web (17) and protrusions (18). Fig. 2b shows the side view of the corner block viewed from transverse wall (15) and Fig. 2c is the top view of the corner block unit.

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Fig. 3a shows the perspective view of the half block unit. This figure shows a pair of sidewalls (19, 20) comprising interlocking means (21, 22) located at one end of the sidewalls, a pair of transverse end walls (23, 24), and a protrusion (25). Fig. 3b shows the side view of the half block unit from the side of transverse wall (23), while Fig. 3c shows the top view of the half block unit.

The above-mentioned interlocking block units form building blocks for an interlocking modular system for construction of load-bearing and non-load-bearing walls without using cement mortar layers between the blocks. In addition, the interlocking mechanism in the horizontal plane is ensured by protrusions (18, 25) in the blocks ensuring connection between adjacent blocks above, below and at each end. The interlocking mechanism provided by the blocks has sufficient strength to resist different types of moments and sheer stresses which develop in load-bearing walls up to five-storey residential buildings, without cement mortar layers. Also, the blocks when assembled have self-alignment features through the provision of groove and tongue means (11, 12, 13, 14) on sidewalls (9, 10) and this results in rapid construction even when using unskilled labor.

Footing and First Course Construction

Two methods of construction are disclosed herein and the main objective of both is to provide very accurate level and alignment of the blocks. The level of the floor and walkway is preferred to be at mid-height of the course to provide satisfactory restraint of the wall at the bottom.

- (a) Casting of continuous footing for the whole structure following the levels that are given by the engineer. Starter bars of the vertical stiffeners (28) must be fixed in position. A very smooth and even surface must be achieved to ease laying of the first course and the subsequent work can be performed as required. It is preferred to cast low grade concrete on both sides of the first course to prevent any movement of the block later on.
- (b) Casting of continuous footing with relatively rough surface for the whole structure, requires that starter bars of the vertical ties must be fixed in position. After the initial setting of the concrete, the first course can be laid following the levels that are given by the engineer and to achieve that cement mortar is required underneath the blocks (conventional construction). As in the first method, the sides of the blocks must be supported by concrete of low grade.

Wall Construction

Laying of the subsequent courses after the first course is carried out as required taking into consideration the following:

- 5 (a) Casting of the vertical ties is performed in stages, being one meter height for each stage, as shown in Fig. 5.
- (b) Casting of vertical ties at each junction of the walls and at the ends of the walls as well, as shown in Fig. 6.
- (c) Casting of horizontal ties and lintels of the openings when the level is reached.
- 10 (d) It is not preferred to erect the structures in different height: courses must be laid evenly for the whole structure.
- (e) The verticality and the alignment of the walls, in addition to the dimensions must be checked for uniformity and preferably before casting of the ties.

15 Fig. 4 shows the procedure for constructing a wall with horizontal ties/stiffeners. These ties are provided at mid-height of walls, last course of walls, above the openings and below the openings. Short horizontal ties are recommended at T-junctions and cross-junctions to provide satisfactory integrity of the junctions. Construction of these ties require hacking the blocks from bottom to provide access for two bars reinforcement to be placed 20 and these ties also require thin plastic sheet (26) below the blocks to serve as permanent form work for the concrete. The height of these ties is preferred not to be less than 100 mm. For the ties at the openings and the top ties, it is preferable to be at the same height of the block (200 mm). Fig. 4 shows the detail of the construction procedure.

Fig. 5 shows the procedure for casting vertical ties. These stiffeners are provided at 25 the corners, ends of walls, T-junction, cross-junction, and around the openings as well. Two bars (27) will be placed in each stiffener (28). Construction of this type of stiffener is carried out in stages at one meter high for each stage. Concrete of the same grade as the block is recommended but wet concrete is preferable so that there is no vibration. Stiffeners are necessary to provide connectivity between walls and foundation, walls and floors, and to 30 handle the concentration of the load of the roof truss. Fig. 5 shows the detail of the construction procedure.

Fig. 6 shows the procedure for the construction of a corner connection. The steps for assembling blocks at a corner connection are as follows:

- (a) Placement of blocks starts with block no. 1 and the sequence of laying the blocks are numbered as shown in Fig. 6. Block no. 10 is the start for the second course and block no. 19 is the start of the third course.
- (b) Vertical stiffeners are constructed at junctions formed by corner blocks e.g., blocks nos. 1, 10 and 19, using in-situ concrete.

Generally, all walls of the structure will contain not less than three vertical stiffeners (28) and not less than two horizontal ties (27).

Fig. 7 shows the procedure for constructing a wall with door opening (29). Generally, 10 all openings will be surrounded with two vertical and two horizontal stiffeners (28). Standard dimensions of doors recommend the height to be 2.1m and for this purpose the level of the floor is preferred to be at mid-height of the first course, hence there will be proper matching at the top. Openings for doors (29) are provided as in the conventional method and the doors are fixed accordingly. Lintels are erected in the same way as horizontal stiffeners (28) but it 15 needs timber support during construction. Fig. 7 shows the detail for construction of door opening (29).

Fig. 8 shows the procedure for constructing a wall with window opening (30). The procedure for construction of window opening is the same as for door opening and in addition it requires a horizontal tie at the bottom of the window. Fig. 8 shows the detail for 20 the construction of the wall with window opening.

While the preferred embodiments of the present invention have been described, it should be understood that various changes, adaptations and modifications may be made thereto. It should be understood, therefore, that the invention is not limited to details of the 25 illustrated invention shown in the figures and that variations in such minor details will be apparent to one skilled in the art.

We claim:

Abstract of the Invention

The present invention relates to an interlocking modular block system for mortarless wall assembly. A plurality of blocks are laid up in courses in a staggered relationship in which three different block configurations are provided, namely stretcher, corner and half block units. The stretcher and corner blocks have lengths at least one and a half times the width, and the half block has the same width and a length which is half the length of the stretcher and corner blocks. The invention offers a simple and fast construction procedure, even when using unskilled labor.